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Intake, digestibility, performance, and carcass traits of rams provided with dehydrated passion fruit (*Passiflora edulis* f. *flavicarpa*) peel, as a substitute of Tifton 85 (*Cynodon* spp.)

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ABSTRACT

Two experiments were performed to evaluate the substitution of Tifton 85 (*Cynodon* spp.) hay by dehydrated passion fruit (*Passiflora edulis* f. *flavicarpa*) peel on intake, digestibility, nitrogen balance, and carcass traits in Santa Inês × Dorper rams. In Experiment 1, 12 rams were penned in individual metabolic crates for 21 days to evaluate DMI, nitrogen balance, and digestibility. Four treatments were evaluated: (1) control, with no inclusion of passion fruit peel; (2) 20% substitution of Tifton 85 hay by passion fruit peel; (3) 40% substitution of Tifton 85 hay by passion fruit peel; and (4) 60% substitution of Tifton 85 hay by passion fruit peel ($n = 3$ rams per treatment). In Experiment 2, 20 rams were randomly assigned into individual dry-lot pens for 63 days, and the same treatments from Experiment 1 were randomly assigned to pens ($n = 5$ pens per treatment). Body weight was weekly determined, and at the end of the experimental period, rams were humanely slaughtered, for assessment of carcass traits. No effect ($P > 0.33$) of passion fruit peel inclusion was observed for DM and CP apparent digestibility. However, NDF apparent digestibility had a quadratic effect ($P = 0.01$). Quadratic regression ($P = 0.02$) was observed for nitrogen intake, but no effect ($P > 0.16$) was observed for fecal and urine nitrogen excretion, and nitrogen balance. Daily DMI, DMI as % of BW, and NDF and CP intake had quadratic effect ($P < 0.01$) with level of inclusion of passion fruit peel in the diet. A quadratic regression ($P < 0.01$) was found for thorax circumference, with peak at 38.6%. Commercial cuts and carcass traits were not affected ($P > 0.16$) by substitution of Tifton-85 by passion fruit peel. In conclusion, these experiments indicate that providing passion fruit peel as a substitute of Tifton 85 in diets for Santa Inês × Dorper rams at approximately 30% can be a good option for producers willing to reduce feeding costs, without impairing performance and carcass traits.

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1. Introduction

Utilizing alternative feedstuff in sheep nutrition, such as by-products from fruit processing, could be a good option for producers willing to decrease feeding costs, particularly during extended drought seasons, when forage quality and quantity are impaired. In Brazil, fruit processing is increasing (BRASIL, 2008) and availability of fruit by-products in some regions has also increased. The use of residues from fruit processing (*e.g.*, pineapple by-product) can increase apparent digestibility coefficients of nutrients, and promote satisfactory animal performance (Costa et al., 2007). Passion fruit (*Passiflora edulis* f. *flavicarpa*) is a popular fruit in Brazil, which is the greatest passion fruit-producing country worldwide, producing in 2013 approximately 838,000 tons (IBGE, 2014). Production of passion fruit in the country and its industrial process (juice industry) is not seasonal because production extends throughout the year (Abreu, 2011). A great amount of residues is generated, corresponding to 60%–70% of total fruit weight (Neiva Júnior et al., 2007). These residues are composed by peel and seeds; according to Cruz et al. (2011), passion fruit peel can be utilized as a good-quality roughage for ruminants, provided fresh or dehydrated. In addition, the usage of these by-products is a good option to reduce disposal and, consequently, environment impact.

Data regarding usage of passion fruit by-products, partially or totally substituting traditional roughage feedstuffs for small ruminants are limited. Knowing the nutritive value of these by-products, as well as digestibility, and animal performance, coupled with knowledge of regional availability and price, is important to inform producers aiming to reduce feeding costs, without impairing animal performance. Therefore, we designed a study to evaluate the effects of increasing substitution of Tifton 85 (*Cynodon* spp.) hay by passion fruit peel on digestibility, nitrogen balance, performance, and carcass traits of Santa Inês crossbred rams.

2. Materials and methods

Starting October 2010, two experiments were conducted at the Federal University of Jequitinhonha and Mucuri Valleys (‘*Universidade Federal dos Vales do Jequitinhonha e Mucuri*’; UFVJM), Research and Experiment Sector, in Curvelo, Minas Gerais state, Brazil (44°23′ W and 18°49′ S). A total of 32 rams was cared for by acceptable practices in accordance with the guidelines as outlined in the Guide for the Care and Use of Agricultural Animals in Research and Teaching (FASS, 2010). In addition, the research protocol was reviewed and approved by the UFVJM, Committee of Ethics on the Use of Animals.

2.1. Animals, diets, and handling

2.1.1. Experiment 1

Twelve Santa Inês × Dorper rams (average body weight [BW] = 21 ± 2.1 kg) were housed in individual metabolic crates for 21 days, consisting of a 14-day acclimation period, and 7 days for data collection. Rams were fed a total mixed ration consisting of corn meal, soybean meal, mineral and vitamin premix, and Tifton 85 hay (Table 1). Four treatments were evaluated: (1) control, with no inclusion of passion fruit peel; (2) 20% substitution of Tifton 85 hay by passion fruit peel; (3) 40% substitution of Tifton 85 hay by passion fruit peel; and (4) 60% substitution of Tifton 85 hay by passion fruit peel (n = 3 rams per treatment). Passion fruit peels, obtained from a local fruit processing plant, were dried under the sun (average atmospheric temperature = 26.5 °C) for approximately 84 h, until reached 82%–86% dry matter (DM), and then ground to 1-cm particle size. Diets were formulated to have equal amount of protein and energy, and were provided twice a day (8:00 and 16:00). Rams had free-choice access to the diets.

Table 1
Feed composition of experimental diets (Experiments 1 and 2).

Ingredients	Treatment[a]			
	Control	20%	40%	60%
% (DM basis)				
Tifton 85 hay	60.0	48.0	36.0	24.0
Passion fruit peel	0	12.0	24.0	36.0
Corn meal	29.0	29.2	29.4	29.6
Soybean meal	9.5	9.3	9.1	8.9
Mineral premix	1.0	1.0	1.0	1.0
Limestone	0.44	0.47	0.55	0.63

[a] Four treatments were evaluated: (1) control, with no inclusion of passion fruit peel; (2) 20% substitution of Tifton 85 hay by passion fruit peel; (3) 40% substitution of Tifton 85 hay by passion fruit peel; and (4) 60% substitution of Tifton 85 hay by passion fruit peel.

During the data collection period, offer and orts were recorded, sampled daily and kept at −10 °C until analysis. Composite samples were dried at 55 °C in a forced-air oven for 72 h for DM calculations. In addition, feces and urine were collected daily in the morning, before feeding. Feces were collected using napa bags, adapted onto the rams’ body, permitting total collection. The total amount of feces produced per day was weighed, sampled, and frozen for further analyses. For urine collection, an aluminum plate was installed slightly leaned underneath the crate to permit drainage of urine into a plastic bucket, that contained 100 mL of 37% HCl diluted in distilled water, to prevent urine nitrogen losses by volatilization and or fermentation. Approximately 10% were sampled, filtered and kept at −20 °C for further analysis.

2.1.2. Experiment 2

Twenty Santa Inês × Dorper rams (initial BW = 30 ± 2.8 kg) were randomly assigned into individual dry-lot pens located in a covered barn. Each dry-lot pen, with approximately 1.4 m^2 of total area, had a water-, mineral-, and feed-trough available. Rams were kept for 63 days, consisting of a 14-day acclimation period, and 49 days for data collection. Before entering into dry-lot, rams were subjected to a deworming protocol, utilizing 10% albendazole (Albendathor 10, Tortuga Cia. Zootec. Agrária, São Paulo, SP, Brazil).

Body weight was weekly measured to determine average daily gain (ADG). Treatments, similar to Experiment 1, were randomly assigned to pens (n = 5 pens per treatment). Feeding was also performed twice a day. Offer and orts were recorded, sampled daily and kept at −10 °C until analyses. Composite samples were dried at 55 °C in a forced-air oven for 72 h for DM calculations. At the end of the dry-lot period, rams were subjected to a 16-h period of water and feed withdrawal. After this period, rams were weighed again to determine the slaughter weight. Rams were then transferred to a packing plant to be humanely slaughtered. Briefly, during the slaughtering process, a hand-held captive bolt gun was used for stunning. After this step, rams had the jugular vein and carotid artery incised, and then were lifted up, upside down, for better bleeding. Corneal reflexes, and if tongues were completely extended, soft and flaccid were checked to ensure proper insensibility. After exsanguination, skinning and evisceration were performed. Non-carcass components (rumen/reticulum, omasum, abomasum, small and large intestine, lungs, trachea and esophagus, heart, spleen, pancreas, kidneys, and blood) were removed and weighed. Carcasses were then longitudinally divided into 2 halves, and the left half was used to harvest 4 commercial cuts (sirloin, shoulder, leg, loin, and breast) that were sectioned and weighed.

2.2. Laboratory analyses and measurements

2.2.1. Experiment 1

Composite offer and ort samples, after drying, were ground in a Wiley mill (Thomas Model 4 Wiley® Mill; Thomas Scientific, Swedeboro, NJ, USA) to pass through a 1-mm stainless steel curved round-hole sieve. Samples were analyzed for DM, crude protein (CP), ether extract (EE), and ash, according to methodology described by Silva and Queiroz (2002). Acid detergent fiber (ADF), neutral detergent fiber (NDF), and lignin were determined using methods described by Van Soest et al. (1991). Condensed tannins were determined only in passion fruit peel utilizing a modified methodology described by Couto (1996). Briefly, for extraction of the tannin, 20 g of the passion fruit peel was boiled in a 1000-mL beaker containing 800 mL of distilled water for 4 h. Afterwards, an aliquot of the resulted solution was harvested for determination of total solids. Another aliquot (100 g) was utilized to determine the Stiasny index (Stiasny, 1905); for this, 10 mL of 37% formaldehyde and 5 mL of HCl were added and gently mixed. The solution was left for 24 h to rest at room temperature. Then, this solution was filtered in a filtering crucible to obtain the precipitate. From this precipitate, the Stiasny index was determined as the ratio of the weight of the precipitate to the weight of the starting sample (Ping et al., 2011). The total solids yield was obtained by multiplying the total solids and the sample weight (20 g). The final value of condensed tannin was obtained by multiplying the total solids yield and the Stiasny index. In addition, non-fibrous carbohydrates (NFC) were calculated by difference (NFC = 100 – NDF – CP – EE – ash) as described by Mertens (1997).

Feces were thawed, homogenized, and 300 g were dried at 55 °C in a forced-air oven for 72 h. Afterwards, samples were ground in a Willey mill to pass through a 1-mm sieve. Dry matter, CP, EE, and NDF were estimated. For urine, samples were thawed, homogenized, once again filtered, and a 100-mL aliquot was utilized to determine total nitrogen content. All feces and urine determinations were achieved using methodologies described by Silva and Queiroz (2002).

Apparent digestibility of DM, NDF, and CP was calculated by finding the difference between nutrient intake from feed and output in feces divided by the feed component intake. Nitrogen balance was calculated as the difference of nitrogen intake and nitrogen loss (fecal and urine nitrogen).

2.2.2. Experiment 2

Samples were processed similarly to Experiment 1. Daily DM, NDF, ADF and CP intake were calculated by the difference between offered and ort DM amounts. Dry matter intake (DMI), expressed as percentage of BW, was calculated as the ratio between DMI and BW.

Biometric measurements were realized after the feed and water withdrawal period, using a flexible measuring tape. Body length (measured from the cranial part of the greater tuberosity of the humerus to the caudal part of the ischial tuberosity), withers and rump heights, thorax circumference and depth, and rump width (measured from the cranial part of the iliac tuberosity to the caudal part of the ischial tuberosity) were collected, after ensuring ram was in proper poise conditions (Teixeira Neto et al., 2012).

After slaughter and processing in the packing plant, hot carcass weight (HCW), dressing-out (DO) percentage, and cold carcass weight (CCW) were determined. After weighing each commercial cut harvested from carcasses, the ratio between cut and carcass weight was calculated.

2.3. Statistical analyses

In Experiment 1, analyses for apparent digestibility of DM, NDF and CP, and nitrogen balance were achieved by regression analysis, for a completely randomized design, using the GLM procedures of SAS (SAS Institute Inc., Cary, NC, USA), and the solution option. In Experiment 2, analyses for DMI, NDF and CP intake, and carcass traits were achieved by regression analysis, for a randomized complete block design, using the GLM procedures of SAS, and the solution option. Initial BW was used as a covariate. Regression equations were developed to evaluate the effects of Tifton 85 substitution by dehydrated passion fruit peel on each item evaluated. In both experiments, significance was set at $P \leq 0.05$.

3. Results and discussion

3.1. Experiment 1

Although not statistically compared, dehydrated passion fruit peel CP and EE levels were greater if compared with Tifton 85 hay, but NDF was lesser (Table 2). Cruz et al. (2011) reported different values for these items. Therefore, nutrient composition assessment of this feedstuff is necessary because variability between batches or variations during fruit processing or even during drying can occur.

No effect ($P > 0.33$) of passion fruit peel inclusion was observed for DM and CP apparent digestibility (Table 3). The average value for DM apparent digestibility was 60.9%, and because diets were isonitrogenous and isocaloric, no

Table 2
Nutrient composition of feedstuffs and treatments (Experiments 1 and 2).

Item,[b] %	Feedstuff[a]			
	Tifton 85 hay	Passion fruit peel	Corn meal	Soybean meal
DM	86.1	83.5	87.2	86.5
% (DM basis)				
CP	4.5	6.8	7.0	46.0
EE	1.7	4.9	4.3	2.6
ADF	49.7	28.2	3.1	9.9
NDF	74.8	53.0	15.2	18.0
Lignin	6.1	11.1	1.2	1.1
Condensed tannin	–	0.46	–	–
	Treatment[c]			
	Control	20%	40%	60%
DM	84.8	86.2	84.3	85.0
% (DM basis)				
CP	9.0	8.9	9.7	9.3
EE	1.9	1.8	1.8	2.1
NFC	28.3	30.9	33.2	35.6
NDF	53.1	51.8	48.3	46.3
ME, Mcal/kg	2.2	2.2	2.2	2.8
Ca	0.5	0.4	0.4	0.4
P	0.2	0.2	0.2	0.2

[a] Feedstuffs utilized in the experimental treatments were sampled 3 times, and values represent an average of the analyses.
[b] ADF = acid detergent fiber; DM = dry matter; CP = crude protein; EE = either extract; NDF = neutral detergent fiber; NFC = non-fibrous carbohydrates; ME = metabolizable energy; Ca = calcium; P = phosphorus.
[c] Four treatments were evaluated: (1) control, with no inclusion of passion fruit peel; (2) 20% substitution of Tifton 85 hay by passion fruit peel; (3) 40% substitution of Tifton 85 hay by passion fruit peel; and (4) 60% substitution of Tifton 85 hay by passion fruit peel.

Table 3
Apparent digestibility of DM, NDF, and CP in rams fed diets containing dehydrated passion fruit peel, as a substitute of Tifton 85 (Experiment 1).

Item[b]	Treatment[a]				SEM	*P*-value
	Control	20%	40%	60%		
DMI, g/ram/d	1049	979	1196	1318	75.8	0.6976
Apparent digestibility (%)						
DM	59.8	61.0	60.6	62.2	7.62	0.3335
NDF	54.9	45.1	42.2	48.3	2.73	0.0065
CP	60.0	64.4	58.0	57.3	1.60	0.4470

[a] Four treatments were evaluated: (1) control, with no inclusion of passion fruit peel; (2) 20% substitution of Tifton 85 hay by passion fruit peel; (3) 40% substitution of Tifton 85 hay by passion fruit peel; and (4) 60% substitution of Tifton 85 hay by passion fruit peel.
[b] DM = dry matter; DMI = dry matter intake; NDF = neutral detergent fiber; CP = crude protein.

Table 4
Nitrogen balance of Santa Inês × Dorper rams, provided with diets with different levels of passion fruit peel, substituting Tifton-85 (Experiment 1).

Item	Treatment[a]				SEM	*P*-value
	Control	20%	40%	60%		
g/day						
Nitrogen intake	15.8	16.9	19.0	20.9	1.13	0.0397
Fecal nitrogen[b]	6.3	6.0	8.3	8.8	0.70	0.1692
Urine nitrogen[b]	4.7	3.8	4.1	5.6	0.40	0.2941
Nitrogen balance	4.8	7.1	6.7	6.5	0.51	0.0258

[a] Four treatments were evaluated: (1) control, with no inclusion of passion fruit peel; (2) 20% substitution of Tifton 85 hay by passion fruit peel; (3) 40% substitution of Tifton 85 hay by passion fruit peel; and (4) 60% substitution of Tifton 85 hay by passion fruit peel.
[b] Nitrogen excreted from feces and urine, respectively.

effect for this item was observed. Similar values were previously reported by Lousada Júnior et al. (2005). For CP apparent digestibility, the average value was 59.9%, which is within the range previously reported elsewhere (Lousada Júnior et al., 2005; Azevêdo et al., 2011). Because diets had similar soybean meal content and it was the main protein source, probably no difference regarding CP degradation from Tifton 85 and passion fruit peel occurred. However, NDF apparent digestibility had a quadratic effect ($P = 0.01$). Deriving the equation ($\hat{Y} = 55.01 - 0.71x + 0.01x^2$), we observed a reduction of NDF apparent digestibility until 35.4% hay substitution by passion fruit peel, increasing

Table 5
Dry matter and nutrient intake, and performance of Santa Inês × Dorper rams fed diets containing dehydrated passion fruit peel, as a substitute of Tifton 85 (Experiment 2).

Item[b]	Treatment[a]				SEM	*P*-value
	Control	20%	40%	60%		
Daily intake						
DM, g	1110.7	1229.9	1498.2	1196.0	83.68	0.0006
DM, %BW	2.8	3.2	3.3	3.2	0.11	0.0019
NDF, g	565.9	620.1	710.9	547.5	36.66	0.3516
CP, g	105.5	113.8	148.5	113.5	9.59	0.0011
Performance (kg/day)						
ADG	0.19	0.21	0.25	0.18	0.02	0.0220
Carcass traits						
HCW, kg	19.0	17.4	20.3	18.7	0.60	0.2329
DO, %	44.1	42.0	45.1	46.8	1.00	0.0038
CCW, kg	18.5	16.7	19.8	18.2	0.64	0.2025

[a] Four treatments were evaluated: (1) control, with no inclusion of passion fruit peel; (2) 20% substitution of Tifton 85 hay by passion fruit peel; (3) 40% substitution of Tifton 85 hay by passion fruit peel; and (4) 60% substitution of Tifton 85 hay by passion fruit peel.
[b] ADF = acid detergent fiber; ADG = average daily gain; CCW = cold carcass weight; CP = crude protein; DM = dry matter; DO% = dressing-out percentage; HCW = hot carcass weight; NDF = neutral detergent fiber.

beyond this value. Similar reduction and increase was observed for NDF intake (data not shown), as the difference was sufficient in providing the quadratic effect of NDF apparent digestibility. The NDF apparent digestibility values ranged from 42.2 to 54.4%, which were similar to previous reports (Lousada Júnior et al., 2005; Neiva et al., 2006).

Linear regression ($P = 0.04$) was observed for nitrogen intake ($\hat{Y} = 15.54 + 0.09x$), and a quadratic effect ($P = 0.03$) was observed for nitrogen balance ($\hat{Y} = 4.96 + 0.11x - 0.001x^2$), as passion fruit peel was included in the diet (Table 4). No effect ($P > 0.16$) of passion fruit inclusion was observed for fecal and urine nitrogen excretion, with average values of 7.3 and 4.6 g/day, respectively. The inclusion of passion fruit peel provided the linear effect on nitrogen intake, because it had greater CP content compared with Tifton 85, resulting in a 5.1-g difference between control and 60% inclusion treatments. Conversely, the linear increase of nitrogen intake did not affect fecal and urine excretion. We observed that for every 1% passion fruit peel inclusion, nitrogen intake increased 0.087 g. Positive values for nitrogen balance indicate that diets meet the maintenance and BW gain requirements for protein. The retained nitrogen ranged from 30 to 40% of the nitrogen intake, which is similar to values reported by Neiva et al. (2006), when substituting Elephant-grass with passion fruit residue. For nitrogen balance, we observed that increase until 33% passion fruit peel inclusion. Greater NFC values provided by passion fruit peel contributed to the improved use of nitrogen in the rumen until the peak inclusion. From this peak, availability of either nutrient limited the increase of nitrogen balance. The greater the value of nitrogen balance, the better is the balance between diet protein and energy, and attainment of the nutritional requirements (Silva and Leão, 1979), with improved nitrogen utilization and less excretion (Gentil et al., 2007). Finally, the greater nitrogen intake was compensated by its improved utilization, with greater inclusion of passion fruit peel.

3.2. Experiment 2

Daily DMI, DMI as % of BW, and CP intake had a quadratic effect ($P < 0.01$) according to the inclusion of passion fruit peel in the diet, with maximum values at 35.0, 39.2, and 35.5% ($\mathrm{DMI} = 1074.76 + 18.42x - 0.26x^2$; $\mathrm{DMI}\ [\%\ \mathrm{of\ BW}] = 2.83 + 0.235x - 0.0003x^2$; and $\mathrm{CP} = 100.74 + 1.91x - 0.03x^2$, respectively; Table 5). Better palatability of diets containing intermediate levels of passion fruit peel is associated with greater intake (Parente et al., 2009). In addition, the increasing inclusion of passion fruit peel in the diet resulted in increased levels of condensed tannins, that impair digestibility due to inhibition of microbial adhesion to feedstuff (Guimarães-Beelen et al., 2006). Other authors (Lousada Júnior et al., 2005; Parente et al., 2009) reported DMI values ranging from 1.2 to 1.6 kg/day. Rams fed diets with 40% inclusion showed the greatest value of DMI, expressed as % of BW, which was similar to the recommended by the NRC (2007) for an animal with an average BW of 30 kg and ADG of 200 g. Lousada Júnior et al. (2005) reported values of 3.5 and, conversely, Parente et al. (2009) reported 5.1%, for lambs fed diets containing passion fruit peel and seeds. Crude protein intake increased until 40% inclusion of passion fruit peel in the diet. This improvement is due to increased DMI, as diets were isonitrogenous. Crude protein intake was greater than 104 g/day, which is the recommended value for a 20-kg ram, gaining 150 g/day (NRC, 2007). As a comparison, Parente et al. (2009) reported greater value (245 g/day) for CP intake.

Quadratic regression ($P = 0.02$) was observed for ADG, with maximum value at 27.8%, according to the regression equation ($\mathrm{ADG} = 0.19 + 0.003x - 0.0001x^2$; Table 5). The improvement of ADG was a consequence of improvement in DMI. Reduction of DMI for 60% inclusion was also the reason for the decreased ADG for this treatment. The presence of condensed tannins probably impaired DMI and consequently ADG because tannins are considered inhibitors of microbial growth (McSweeney et al., 2001).

Important ruminal microorganisms such as *Fibrobacter succinogenes*, *Ruminococcus albus*, and *Ruminococcus flavefaciens* are substantially inhibited because the presence of condensed tannins (Bae et al., 1993; Nelson et al., 1997; Guimarães-Beelen et al., 2006).

Body length, withers and rump height, thorax depth, and rump width were not affected ($P > 0.07$) by passion fruit peel inclusion (average values = 42.5, 66.9, 68.7, 27.1, and 21.0 cm, respectively). Conversely, a quadratic regression ($P < 0.01$) was found for thorax circumference ($\hat{Y} = 72.97 + 0.22x - 0.003x^2$), with peak at 38.6%. Greater thorax circumference observed for 40% passion fruit peel inclusion is because greater BW observed at the end of the drylot period (45.7 kg *vs.* 38.4; 37.4; and 37.2 kg for control; 20%; and 60% inclusion treatments, respectively). Biometric measurements could be used as an option when determining BW is difficult or not available, as BW and thorax circumference seem to be correlated (Costa Júnior et al., 2006).

Leg, sirloin, loin, and breast weights were not affected ($P > 0.23$) by passion fruit peel inclusion (average values = 2079, 469.5, 1298, and 1493.2 g, respectively), as well as cut yield (average values = 2.6, 6.9, 11.8, 7.1, and 8.1% for sirloin, shoulder, leg, loin, and breast, respectively). However, inclusion of passion fruit peel in diets showed a quadratic regression ($P = 0.04$) for shoulder ($\hat{Y} = 1184.25 + 0.61x - 0.14x^2$), with peak at 34.2%. This difference is justified by the greater BW gain for rams provided 40% passion fruit peel inclusion.

Carcass traits were not affected ($P > 0.16$), as well as non-carcass components ($P > 0.22$; data not shown) by inclusion of passion fruit peel. However, DO percentage had a quadratic effect ($P < 0.01$), with minimum value at 18.5% passion fruit peel inclusion ($\hat{Y} = 43.79 - 0.09x + 0.002x^2$). Even with differences in DMI among treatments, and the fact that NDF apparent digestibility was lesser for 40% substitution, these factors did not affect organ weight. In addition, different diets were not effective in altering organ development and weight. Other authors (Tonetto et al., 2004; Yamamoto et al., 2004) also reported no difference in non-carcass components, in finishing lambs kept in feedlot, receiving different diets, as well as no difference in DO percentage (Rodrigues et al., 2008; Parente et al., 2009).

4. Conclusions

In conclusion, these experiments indicate that providing passion fruit peel as a substitute of Tifton 85 in diets for Santa Inês × Dorper rams at approximately 30% can be a good option for producers willing to reduce feeding costs, without impairing performance and carcass traits. Substitution of Tifton 85 hay by passion fruit peel above 30% impact intake and performance. It is important to note that the use of this feedstuff is recommended when it is easily available and cost effective.

Conflict of interest

The authors declare that none of them has any conflict of interest.

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